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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER
DHINGRA, RAKESH KUMAR

ART UNIT	PAPER NUMBER
1792	

NOTIFICATION DATE	DELIVERY MODE
07/16/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/524,038	ISHIBASHI ET AL.	
	Examiner	Art Unit	
	RAKESH K. DHINGRA	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 May 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,5-7,9-11,15,18,19,23 and 24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,5-7,9-11,15,18,19,23 and 24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 October 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/6/09 has been entered.

Response to Arguments

Applicant's arguments with respect to claims 1, 5-7, 9-11, 15, 18, 19, 23, 24 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claims 1, 11 by adding new limitation (e.g. in claims 1, 11 new limitation like "the dielectric flat plate portion extending substantially horizontally to the chamber side walls" etc have been added. and

Claims 1, 5-7, 9-11, 15, 18, 19, 23 and 24 are presently pending and active.

Further, applicant's argument that Mabuchi does not disclose or suggest claim limitation that the sidewall portion of the dielectric plate is disposed on the inner side of the sidewall of the chamber, is found be persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made over Kazumi in view of Chen as explained below, since Kazumi (Figs. 2, 3) teaches newly added limitations "the dielectric flat plate portion extending substantially horizontally to the chamber side walls", and "a dielectric sidewall portion formed to extend from a peripheral region of the flat plate portion towards the

substrate along the chamber side walls towards the substrate in a plasma generation region", as explained below.

Accordingly claims 1, 5-7, 9 and 10 have been rejected under 35 USC 103 (a) as explained below. Further, Kazumi et al when combined with Chen et al and Ohmi et al reads on amended claim 11 limitations. Accordingly claims 11, 15, 18, 19, 23, 24 have also been rejected under 35 USC 103 (a) as explained below.

Regarding applicant's argument that Chen does not disclose claim 1, 11 limitation that "microwave is supplied towards a periphery portion of the substrate thereby enhancing a uniformity of a plasma density in a radial direction of the substrate", examiner responds that Chen teaches that microwaves are supplied from the waveguides 106, 107 into the top plate 100 and the microwaves travel towards the peripheral portion of the top plate. Chen also teach that the geometry of the dielectric top plate 100 is optimized to obtain improved uniformity of plasma density, as well as obtain spatially uniform electric field in the chamber. It would be obvious to optimize the shape and cross-section of the top plate as per teaching of Chen to obtain enhanced plasma density uniformity. Thus, Chen teach claims 1, 11 limitation "microwave is supplied towards a periphery portion of the substrate thereby enhancing a uniformity of a plasma density in a radial direction of the substrate".

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter

sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 5-7, 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kazumi et al (JP 2000-331998) in view of Chen et al (US 5,234,526).

Regarding Claim 1: Kazumi et al teach a plasma apparatus comprising:

a chamber 20 for accommodating a substrate 27;

a dielectric top plate unit 23 disposed in an upper portion of the chamber;

an antenna 50 having a plurality of slots 50A for irradiating a microwave towards an inside of the chamber 26 through the top plate member 23, the antenna 50 being disposed on the top plate member 23 and being in close contact therewith;

a gas injection opening 29 for supplying a processing gas into the chamber; and a vacuum pump for exhausting the inside of the chamber through exhaust outlet 30 ,

wherein the top plate member 23 includes:

a dielectric flat plate portion 23A formed to face the substrate; and

a dielectric sidewall portion 23B formed to extend from a peripheral region of the flat plate portion 23A along the chamber sidewalls towards the substrate in a plasma generation region. Kazumi et al also teach that the dielectric plate 23 can have a spread stair like configuration of the dielectric plate (Fig. 2) so that a dielectric plate 40 has a dielectric flat plate portion 40A extending substantially horizontally to the chamber side walls, and a dielectric sidewall portion 40A formed to extend from a peripheral region of the flat plate portion along the chamber side walls towards the substrate 27 in the plasma generation region (e.g. Figs. 2, 3 . 3 and para. 0023-0026 and 0030-0035).

Kazumi et al do not teach wherein sides of the flat portion and the sidewall portion have a curved surface facing a plasma generation region and extending between the flat plate portion and the sidewall portion and the sidewall portion has a thickness not smaller than $\lambda g/4$ but not greater than λg , λg being a wavelength of the microwave, and

wherein the microwave propagates from the flat plate portion to the sidewall portion and then is supplied towards a periphery portion of the substrate, thereby enhancing a uniformity of a plasma density in a radial direction of the substrate.

Chen et al teach a plasma apparatus with a gas injection opening 38, an evacuation opening 3a (normally connected to a vacuum pump) and further comprising a top plate unit with a flat plate portion and a side wall portion that extends towards a substrate. Chen et al further teach that window can also be made in two pieces like a flat plate portion 100c and a curved piece 100d Fig. 6b), so that the sides of the flat portion and the sidewall portion have a curved surface facing a plasma generation region and extending between the flat plate portion and the sidewall portion (e.g. Figs. 5, 6b). Chen et al also teach that the shape of window with

the sidewall (Fig. 4) results in a relative increase of peripheral field electric field and enhanced homogeneity of plasma. Chen et al also teach that geometry and material properties of the dielectric top plate are optimized to obtain improved uniformity of plasma density, as well as obtain spatially uniform electric field in the chamber. Chen et al additionally teach that as an example (Fig. 3) for proper matching, the thickness of the dielectric top plate 9 is made equal to ¼ times lambda.g, multiplied by an integer. It would be obvious to optimize the geometry of top plate that is, shape of recess or cross-section profile including the side wall portion (as a result effective variable) as per teaching of Chen et al to control and optimize the plasma distribution in the process chamber (e.g. Figs. 3, 4, 6a, 6b, 8, 14a and col. 8, lines 50-68 and col. 12, lines 60-68 and col. 15, line 44 to col. 16, line 25).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the shape and thickness of the side wall portion of the top plate as taught by Chen et al in the apparatus of Kazumi et al to obtain enhanced uniformity of plasma density distribution and obtain uniform plasma in the process chamber.

In this connection courts have ruled:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Regarding Claim 5: Kazumi et al teach gas injection opening 29 for supplying gas into chamber along the side wall portion (Fig. 3).

Regarding Claims 6, 10: Chen et al teach that an outer periphery of side wall portion 120b is covered with a conductor 124 (metal wall of the chamber) without any gap (Fig. 14a).

Regarding Claim 7: Chen et al teach that inner shape of the dielectric top plate unit 120 is bell-jar type (Fig. 14a).

Regarding Claim 9: Kazumi et al teach a gap 25 between the side wall portion 23 and the conductor 20 (metal chamber wall) [Fig. 3 and para. 0023].

Claims 11, 15, 18, 19, 23, 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kazumi et al (JP 2000-331998) in view of Chen et al (US 5,234,526) and Ohmi et al (US 2002/0020498).

Regarding Claim 11: Kazumi et al in view of Chen et al teach all limitations of the claim (as already explained above under claim 1) including a dielectric top plate unit having a dielectric flat plate portion 40A extending substantially horizontally to the chamber side walls, and a dielectric sidewall portion 40A formed to extend from a peripheral region of the flat plate portion along the chamber side walls towards the substrate 27 in the plasma generation region, and a slot antenna 50 in close contact with the dielectric top plate unit. Further, Chen et al teach a plasma apparatus with a top plate 100 such that the sides of the flat portion and the sidewall portion have a curved surface facing a plasma generation region and extending between the flat plate portion and the sidewall portion (e.g. Figs. 5, 6b). Chen et al also teach that geometry and material properties of the dielectric top plate are optimized to obtain improved uniformity of plasma density, as well as obtain spatially uniform electric field in the chamber. It would be obvious to optimize the geometry of top plate that is, shape of cross-section profile including the side wall portion (as a result effective variable) as per teaching of Chen et al to control and optimize the plasma distribution in the process chamber Further, in the apparatus of Chen et al the microwaves would obviously flow from the flat plate portion of the top plate 100 to the side

wall portion and then supplied towards the substrate (including the peripheral portion of the substrate).

Kazumi et al in view of Chen et al do not teach a gap distance between the top plate unit and the antenna being equal is smaller than lambda g/10, lambda g being a wavelength of microwaves.

Ohmi et al teach a microwave plasma apparatus with a slot antenna 6 that is disposed above a dielectric top plate 2 with a gap d1, wherein the gap is set to be around 6 mm, which is smaller than lambda./10 (that is 1.22 cm) so as to obtain improved plasma density [e.g. Fig. 1 and para. 0035).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a gap that is equal to or smaller than lambda/10 between the antenna and the dielectric top plate, as taught by Ohmi et al in the apparatus of Kazumi et al in view of Chen et al to obtain improved plasma density uniformity in the processing chamber.

Regarding Claim 15: Chen et al teach a plasma apparatus with a top plate unit with a flat plate portion and a side wall portion that extends towards a substrate. Chen et al further teach that window can also be made in two pieces like a flat plate portion 100c and a curved piece 100d, so that the sides of the flat portion and the sidewall portion facing a plasma generation region have a curved surface extending between the flat plate portion and the sidewall portion (e.g. Fig 6b). Chen et al also teach that the shape of window with the sidewall (Fig. 4) results in a relative increase of peripheral field electric field and enhanced homogeneity of plasma. Chen et al also teach that geometry and material properties of the dielectric top plate are optimized to optimize the microwave distribution in the chamber, and also as per required microwaves modes. Chen et al additionally teach that as an example (Fig. 3) for proper matching, the thickness of the

dielectric top plate 9 is made equal to ¼ times lambda.g, multiplied by an integer. It would be obvious to optimize the geometry of top plate that is, shape of recess or cross-section profile including the side wall portion (as a result effective variable) as per teaching of Chen et al to control and optimize the plasma density distribution in the process chamber (e.g. Figs. 3, 4, 8, 14a and col. 8, lines 50-68 and col. 12, lines 60-68 and col. 15, line 44 to col. 16, line 25).

Regarding Claim 18: Chen et al teach that inner shape of the dielectric top plate unit 120 is bell-jar type (Fig. 14a).

Regarding Claim 19: Kazumi et al teach gas injection opening 29 for supplying gas into chamber along the side wall portion (Fig. 3).

Regarding Claims 23, 24: Ohmi et al teach that all microwaves irradiated towards the inside of the chamber are introduced through the slots and the top plate (Ohmi et al – Fig. 1).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. K. D./
Examiner, Art Unit 1792

/Karla Moore/
Primary Examiner, Art Unit 1792